

REMARKS/ARGUMENTS

This amendment is responsive to the Office Action mailed 8/18/2009 wherein:

Claims 12-23, 32, 33, and 35-38 were rejected under USC §101 as not falling within one of four statutory categories of invention [section 9];

Claim 23 was rejected under USC §112, first paragraph, as failing to comply with the written description requirement [section 11];

Claims 1-3, 5, 12, 13, 24-26, and 31 were rejected under USC §103(a) as being unpatentable over *Tuy et al.* (US 5,297,043) in view of *De Bonet* (US 6,535,642) [section 13];

Claims 4 and 7 were rejected under USC §103(a) as being unpatentable over *Tuy et al.* '043 and *De Bonet* '642 in view of *Scorse, et al.* (US 5,128,776) [section 18];

Claims 6 and 8 were rejected under 35 USC §103(a) as being unpatentable over *Tuy et al.* '043 and *De Bonet* '642 in view of *Ransford, et al.* (EP 479,563 A2) [section 21];

Claim 14 was rejected under USC §103(a) as being unpatentable over *Tuy et al.* '043 and *De Bonet* '642 in view of *Peschmann et al* (US 4,610,021) [section 24];

Claims 15 and 16 were rejected under USC §103(a) as being unpatentable over *Tuy et al.* '043 and *De Bonet* '642 in view of *Sutherland, et al.* (US PUB 2005/0277823 A1) [section 26];

Claims 17 and 18 were rejected under USC §103(a) as being unpatentable over *Tuy et al.* '043 and *De Bonet* '642 in view of *Chui, et al.* (US 5,541,473) [section 29];

Claim 19 was rejected under USC §103(a) as being unpatentable over *Tuy et al.* '043 and *De Bonet* '642 and *Chui, et al.* '473 in view of *Reinsch* (US 5,134,661) [section 32];

Claims 20-22 were rejected under USC §103(a) as being unpatentable over *Tuy et al.* '043, *De Bonet* '642, and *Okazi* (US 5,311,869) [section 33];

Claim 23 was rejected under USC §103(a) as being unpatentable over *Tuy et al.* '043 and *De Bonet* '642, and further in view of *Nishihara et al.* '317 [section 35];

Claims 32, 33 and 36-38 are rejected under USC §103(a) as being unpatentable over *Tuy et al. '043*, *De Bonet '642*, and *Peschman et al. '021* and further in view of *Sutherland et al.* [section 37]; and

Claims 35 was rejected under USC §103(a) as being unpatentable over *Tuy et al. '043*, *De Bonet '642*, *Peschman et al. '021*, *Sutherland, et al.*, and further in view of *Matsugu et al.* (US 6,167,167) [section 42].

Claims 1, 12, 14-15, 17, 20, 24, and 31-32 were amended. Claim 23 was canceled. No claims were added.

Claims 1-8, 12-22, 24-26, 31-33, and 35-38 remain pending in this Application. Reconsideration in light of the following remarks is respectfully requested.

Claim Rejections under 35 USC §101

In section 9 of the Action, Claims 12-23, 32-33, and 35-38 were rejected under USC §101 as not falling within one of four statutory categories of invention. Accordingly, Claims 12, 14, 15, 17, 20, and 32 were amended to more explicitly claim that the distribution of pixels in an image acquired from an imaging device is transformed via any of the claimed methods.

Claim Rejection under 35 USC §112, first paragraph

In section 11 of the Action, Claim 23 was rejected under USC §112, first paragraph, as failing to comply with the written description requirement. Accordingly, Claim 23 has been canceled, without prejudice, to expedite allowance of the present Application.

Claim Rejections under 35 USC §103(a)

In section 13 of the Action, Claims 1-3, 5, 12-13, 23-26, and 31 were rejected under USC §103(a) as being unpatentable over *Tuy et al. '043* in view of U.S. Patent No. 6,535,642 issued to *De Bonet*.

Tuy et al. '043

Tuy et al. '043 teaches a computed tomography scanner or other medical diagnostic imager for generating volume image data, where an operator defines a volume, and a plurality of interconnected polygons define the (three-dimensional) volume specified by the operator. The polygons are selected to define a subregion to be viewed (Abstract). That is, the reference

teaches the selection of defined volumetric subregions. In particular, image data are acquired and stored as “p planes of $m \times n$ data” (col. 4, lines 66-68), where the operator “select[s] the boundaries of a volumetric subregion to be displayed” (col. 5, lines 23-24). This can best be seen with reference to Fig. 2 of *Tuy et al. '043* which shown p planes of $m \times n$ data, and to Fig. 3C which shows a volumetric subregion comprising portions of the p planes. The operator uses a control panel to define the volume of interest (i.e., the volumetric subregion) and to cause the defined volume to be displayed on a video screen (col. 5, lines 36-39). As stated by the Examiner, *Tuy et al. '043* does not expressly teach the selection of an entire image, in contrast to the methods claimed by the Applicants. Moreover, as noted by the Applicants, *Tuy et al. '043* further fails to teach or suggest the use of an integer wavelet transform to apply compression to selected image data.

De Bonet '642

De Bonet '642 teaches a computer-implemented data compression system and process that employs an approximate string matching scheme (col. 1, lines 8-11). The cited reference states that “certain types of image signals are both very large and contain sensitive details” (col. 1, lines 22-24) but fails to explicitly refer to “an entire image” as claimed by the Applicants. Figure 2 of the reference provides a “general architecture of the lossless compression system embodying the...invention...[where] source data 200 is passed through an encoder 202 that compresses the data using some encoding scheme. The compressed data or code 204 contains all the information present in the source data, but is smaller” (col. 6, lines 59-64). As shown in Figure 3 of the cited reference, an “encoder 302 employs an encoding process that can be thought of as a transformation from source data 300 into compressed code 304” where the “source data 300 is typically composed of data values 306” and the “compressed code 304 consists of a plurality of offset-count pairs 308 each of which identifies the start and length of a block of earlier occurring source data 300 and a list of residual values 310 associated with an offset-count pair that reflects the differences between the identified block and the true values of the block of source data being encoded” (col. 7, lines 6-16). The Applicants note that *De Bonet '642* similarly fails to teach or suggest the use of an integer wavelet transform to apply compression to image data.

The Examiner asserts in section 14 that, regarding claims 1, 12, 24, and 31, *Tuy et al. '043* discloses the following:

- providing a span of interest for an acquired image sequence, wherein the span of interest defines a time sequence and a space sequence in the acquired image sequence that includes analytically relevant information in the acquired image sequence [Fig. 1, refs. B (acquired image sequence), Figs. 2 (acquired image sequence), 3A, 3B, and 4; col. 4, lines 55-58; col. 5, lines 22-24; and col. 6, lines

23-25]

- selecting at least one frame of the acquired image sequence in the span of interest [similarly - Fig. 1, refs. B (acquired image sequence), Figs. 2 (acquired image sequence), 3A, 3B, and 4; col. 4, lines 55-58; col. 5, lines 22-24; and col. 6, lines 23-25]; the Examiner notes that paragraph 17, lines 9-11, of the pending Application discloses that a frame is a snapshot of a part of an image
- displaying at least one analytically relevant image, thereby displaying the analytically relevant information [Fig. 1, ref. C; col. 5, lines 22-24]; the Examiner notes that paragraph 17, lines 9-11, of the pending Application discloses that a frame is a snapshot of a part of an image

The Examiner further asserts that, in Fig. 3A, *Tuy et al. '043* discloses a cube to select a region of interest [col. 5, lines 22-29] and the cube as disclosed does not preclude the selection of an entire image, it does expressly disclose as such, either. The Examiner additionally asserts that, *De Bonet '642* suggests selecting the entire image [col. 1, lines 22-26 and col. 6, lines 59-66] and lossless compress/decompress it [Fig. 2, refs. 202 (compress) and 210 (decompress)].

The Applicants claim in Claim 1, as amended, a method of image compression and decompression for an imaging technique performed by an imaging device comprising: providing a span of interest for an acquired image sequence wherein the span of interest defines a time sequence and a space sequence in the acquired image sequence that includes analytically relevant information in the acquired image sequence; selecting at least one frame in the acquired image sequence in the span of interest, the at least one frame including at least a single image obtained from the imaging device for the imaging technique being used; applying lossless compression using an integer wavelet transform to the distribution of pixels in the at least one frame and obtaining therefrom at least one compressed image; applying decompression to the at least one compressed image and obtaining therefrom at least one analytically relevant image; and displaying the at least one analytically relevant image, thereby displaying the analytically relevant information.

The Applicants further note that *De Bonet '642* teaches a lossless data compression system, but a system which does not select a frame in an acquired image sequence in a span of interest and which does not apply compression using an integer wavelet transform, as claimed by the Applicants. Rather, the system and process taught by the cited reference: (i) "employs a unique approximate string matching scheme" where "the encoding portion of this system and process entails identifying mutually exclusive blocks of data values within the source data being encoded that have lengths, which [are] represented with the pointer-residual approach;" (ii) "earlier occurring blocks are chosen so that when compared to the optimal block, their difference exhibits the lowest possible entropy;" (iii) the choice of a block of earlier occurring source data for use in forming a residual data block is based on a cost analysis which is designed

to minimize the entropy of differences between the previous block and the new block of source data;" and (iv) "to create blocks of residual data having a highly kurtotic distribution so that most of the data is centered around zero." "In addition to the residual data, a series of pointers are generated. Each pointer is initially affiliated with a separate one of the optimal blocks and identifies the location and length of the block of earlier occurring source data associated with this optimal block" (col. 2, line 52 to col. 3, line 11). Where data compression is applied, the cited reference discloses the use of entropy-based compression techniques, such as Huffman, Shannon-Fano, LZ77, LZW, and PPM (col. 3, lines 5-7).

The Applicants note that *Tuy et al. '043* teaches storing image data as "p planes of $m \times n$ data" where "any of the p planes of data can be readily withdrawn from the memory, converted to a video signal by a video processor means 20 and displayed on the video monitor C" (col. 4, line 66 to col. 5, line 9). *Tuy et al. '043* thus does not teach the compression and decompression of image data. The Applicants respectfully submit that claim 1 is not unpatentable over *Tuy et al. '043* and *De Bonet '642* which, in combination, fail to teach: obtaining a single image from at least one frame, and applying lossless compression using an integer wavelet transform to the distribution of pixels in the at least one frame.

The Applicants further submit that this argument also applies to the other independent claims 12, 14, 15, 17, 20, 24, 31, and 32 as amended. Accordingly, the Applicants respectfully request that the rejection of these Claims, as well as dependent Claims 2-3, 5, 13, and 25-26 under 35 USC §103(a), be withdrawn.

The Examiner asserts in section 15 that, regarding claims 2, 3, 25, and 26, *Tuy et al. '043* further discloses the following:

- [Fig. 3c] wherein the at least one frame comprises a plurality of frames in time sequence (claims 2 and 26)
- [Fig. 3c] wherein the at least one frame comprises a plurality of frames in space sequence (claims 3 and 25)

The Examiner asserts in section 16 that, regarding claim 5, the combination of *Tuy et al. '043* and *De Bonet '642* discloses the following:

- [Tuy, Fig. 1, ref. 32] wherein selecting the at least one frame in the acquired image sequence comprises using a user select option for selecting the portion of the image

The Examiner asserts in section 17 that, regarding claim 13, *Tuy et al. '043* further discloses the following:

- [Tuy, Fig. 1, ref. A and col. 4, lines 21-27] wherein the imaging device is a medical imaging device selected from the group consisting of a magnetic resonance imaging system, a computed tomography system, an x-ray system, an x-ray angiogram system, and an ultrasound system

The Applicants respectfully submit that the combination of *Tuy et al.* '043 and *De Bonet* '642 fails to teach: selecting at least one frame, obtaining a single image from at least one frame, and applying lossless compression using an integer wavelet transform to the distribution of pixels in the at least one frame. Accordingly, the Applicants respectfully request that the rejection of Claims 5 and 13 under 35 USC §103(a), be withdrawn.

In section 18 of the Action, Claims 4 and 7 were rejected under USC §103(a) as being unpatentable over *Tuy et al.* '043 and *De Bonet* '642, and further in view of U.S. Patent No. 5,128,776 issued to *Scorse et al.*

The Examiner asserts in section 19 that, regarding claim 4, *Scorse et al.* '776 discloses the following limitation that is not expressly disclosed in the combined invention of *Tuy et al.* '043 and *De Bonet*:

- [Scorse, Fig. 1, ref. 34 and 38; and col. 4, lines 20-22] archiving the at least one analytically relevant image

The Examiner asserts in section 20 that, regarding claim 7, *Scorse et al.* '776 further discloses the following limitation that is not expressly disclosed in the combined invention of *Tuy et al.* '043 and *De Bonet*:

- [Scorse, Fig. 1, ref. 18; and col. 4, lines 35-37] wherein the user select option comprises manually marking frames of interest

The Applicants respectfully submit that the combination of *Tuy et al.* '043, *De Bonet* '642, and *Scorse et al.* '776 fails to teach: selecting at least one frame, obtaining a single image from at least one frame, applying lossless compression using an integer wavelet transform to the distribution of pixels in the at least one frame, and either archiving an analytically relevant image or manually marking frames of interest. Accordingly, the Applicants respectfully request that the rejection of Claims 4 and 7 under 35 USC §103(a), be withdrawn.

In section 21 of the Action, Claims 6 and 8 were rejected under 35 USC §103(a) as being unpatentable over *Tuy et al.* '043 and *De Bonet* '642 in view of *Ransford, et al.* (EP 479,563 A2)

The Examiner asserts in section 22 that, regarding claim 6, *Ransford et al.* discloses the following limitation that is not expressly disclosed in the combined invention of *Tuy et al.* '043 and *De Bonet*:

- [Ransford, col. 11, lines 28-32] wherein the user select option comprises segmenting an identifiable anatomy of a patient

The Examiner asserts in section 23 that, regarding claim 8, *Ransford et al.* further discloses:

- [Ransford, col. 11, lines 28-32] wherein the user select option comprises sketch-gripping an image boundary

The Applicants submit that, as the combination of *Tuy et al. '043*, and *De Bonet '642*, and *Ransford et al.* fails to teach: selecting at least one frame, obtaining a single image from at least one frame, applying lossless compression using an integer wavelet transform to the distribution of pixels in the at least one frame, and either segmenting an identifiable anatomy of a patient or sketch-gripping an image boundary. Accordingly, the Applicants respectfully request that the rejection of Claims 6 and 8 under 35 USC §103(a), also be withdrawn.

In section 24 of the Action, Claim 14 was rejected under USC §103(a) as being unpatentable over *Tuy et al. '043* and *De Bonet '642* in view of *Peschmann et al* (US 4,610,021).

The Examiner asserts in section 25 that, regarding claim 14, *Peschman et al. '021* discloses the following limitation that is not expressly disclosed in the combined invention of *Tuy et al. '043* and *De Bonet*:

- [Peschman, Fig. 5, refs. 72-76; col. 4, line 21 to col. 5, line 5] wherein the space sequence is defined by a circular zone in a collimator ring

The Applicants submit that, as the combination of *Tuy et al. '043*, *De Bonet '642*, and *Peschman et al. '021* fails to teach: selecting at least one frame, obtaining a single image from at least one frame, and applying lossless compression using an integer wavelet transform to the distribution of pixels in the at least one frame, in a space sequence defined by a circular zone in a collimator ring. Accordingly, the Applicants respectfully request that the rejection of Claim 14 under 35 USC §103(a), also be withdrawn.

In section 26 of the Action, Claims 15 and 16 were rejected under USC §103(a) as being unpatentable over *Tuy et al. '043* and *De Bonet '642* in view of *Sutherland, et al.* (US PUB 2005/0277823 A1).

The Examiner asserts in section 27 that, regarding claim 15, *Sutherland et al.* (USPUB 2005/0277823) discloses the following limitation that is not expressly disclosed in the combined invention of *Tuy et al. '043* and *De Bonet*:

- [Sutherland, Figs. 6A-C, 7A, 9A-B, Abstract; paragraphs 3, 12, 41-45, 56, 69-70] capturing x-ray angiograms as image frames and comparing a series of angiograms

over a time period (between two time instances) for diagnostic purposes

The Examiner asserts in section 28 that, regarding claim 16, *Sutherland et al.* teaches/suggests a span for analysis as the span when the dye is present [para. 3, last 3 lines].

The Applicants submit that, as the combination of *Tuy et al. '043*, *De Bonet '642*, and *Sutherland et al.* fails to teach: selecting at least one frame, obtaining a single image from at least one frame, applying lossless compression using an integer wavelet transform to the distribution of pixels in the at least one frame, and capturing x-ray angiograms as image frames and either comparing a series of angiograms over a time period for diagnostic purposes or specifying a time instance to begin or end when a dye appears or disappears. Accordingly, the Applicants respectfully request that the rejection of Claims 15 and 16 under 35 USC §103(a), also be withdrawn.

In section 29 of the Action, Claims 17 and 18 were rejected under USC §103(a) as being unpatentable over *Tuy et al. '043* and *De Bonet '642* in view of *Chui, et al.* (US 5,541,473).

The Examiner asserts in section 30 that, regarding claim 17, *Chui et al. 473* discloses compressing MRI image sequences [col. 6, lines 36-44].

The Examiner asserts in section 31 that, regarding claim 18, *Tuy et al. '043* discloses a plurality of frames in a space sequence [Fig. 3C].

The Applicants submit that, as the combination of *Tuy et al. '043*, *De Bonet '642*, and *Chui et al. 473* fails to teach: selecting at least one frame, obtaining a single image from at least one frame, applying lossless compression using an integer wavelet transform to the distribution of pixels in the at least one frame, and capturing x-ray angiograms as image frames and either compressing MRI image sequences or specifying that a plurality of frames includes a space sequence. Accordingly, the Applicants respectfully request that the rejection of Claims 17 and 18 under 35 USC §103(a), also be withdrawn.

In section 32 of the Action, Claim 19 was rejected under USC §103(a) as being unpatentable over *Tuy et al. '043* and *De Bonet '642* and *Chui, et al. '473* in view of *Reinsch* (US 5,134,661)

The Examiner asserts in section 32 that, regarding claim 19, *Reinsch* (US 5,134,661) suggests using a edge detection to select areas of interest [Abstract, lines 1-9], a limitation that is not expressly disclosed in the combined invention of *Tuy et al. '043* and *De Bonet*.

The Applicants submit that, as the combination of *Tuy et al. '043*, *De Bonet '642*, and

Reinsch '661 fails to teach: selecting at least one frame, obtaining a single image from at least one frame, applying lossless compression using an integer wavelet transform to the distribution of pixels in the at least one frame, and using a edge detection to select areas of interest. Accordingly, the Applicants respectfully request that the rejection of Claim 19 under 35 USC §103(a) be withdrawn.

In section 33 of the Action, Claims 20-22 were rejected under USC §103(a) as being unpatentable over *Tuy et al. '043*, *De Bonet '642*, and *Okazi* (US 5,311,869).

The Examiner asserts in section 34 that, regarding claim 20, *Okazaki* (US 5,311,869) discloses using an ultrasound device to acquire image data [Abstract; Fig. 4, ref. 16; col. 6, lines 8-34], a limitation that is not expressly disclosed in the combined invention of *Tuy et al. '043* and *De Bonet*.

The Examiner further asserts in section 34 that, regarding claims 21 and 22: *Nishihara et al. '317* discloses automatic selection of region of interest [Fig. 9, ref. 68 and col. 8, lines 36-59], *Tuy et al. '043* teaches manual selection of ROI [Fig. 1, refs. 20, 32, and C; col. 5, lines 22-46], and *Okazaki '869* discloses the acquired images are fan shaped [ref. 42 in Figs. 1, 4, 8(A) and 8(B); col. 1, lines 31-34 and 49-51; col. 8, lines 8-64] - limitations that are not expressly disclosed in the combined invention of *Tuy et al. '043*, *Okazaki '869* and *De Bonet*.

The Applicants submit that, as the combination of *Tuy et al. '043*, *De Bonet '642*, and *Okazaki '869* or *Nishihara et al. '317* fails to teach: selecting at least one frame, obtaining a single image from at least one frame, applying lossless compression using an integer wavelet transform to the distribution of pixels in the at least one frame, where either: using an ultrasound device to acquire image data; selection of a region of interest is automatic; or acquired images are fan shaped. Accordingly, the Applicants respectfully request that the rejection of Claims 20-22 under 35 USC §103(a), also be withdrawn.

In section 35 of the Action, Claim 23 was rejected under USC §103(a) as being unpatentable over *Tuy et al. '043* and *De Bonet '642*, and further in view of *Nishihara et al. '317*.

The Examiner asserts in section 36 that, regarding claim 23, *Nishihara et al. '317* discloses lossily compressing/decompressing a second region that is not the selected first portion – the ROI [Fig. 9; col. 8, lines 36-46], a limitation that is not expressly disclosed in the combined invention of *Tuy et al. '043* and *De Bonet*.

The Applicants submit that, as the combination of *Tuy et al. '043*, *De Bonet '642*, and *Nishihara et al. '317* fails to teach: selecting at least one frame, obtaining a single image from at

least one frame, applying lossless compression using an integer wavelet transform to the distribution of pixels in the at least one frame, and lossily compressing/decompressing a second region that is not the selected first portion. Accordingly, the Applicants respectfully request that the rejection of Claim 23 under 35 USC §103(a) be withdrawn

In section 37 of the Action, Claims 32, 33 and 36-38 were rejected under USC §103(a) as being unpatentable over *Tuy et al. '043*, *De Bonet '642*, and *Peschman et al. '021* and further in view of *Sutherland et al.*

The Examiner asserts in section 38 that, regarding claim 32, *Sutherland et al.* suggests a time sequence based on a dye, a limitation that is not expressly disclosed in the combined invention of *Tuy et al. '043*, *De Bonet*, and *Peschman et al.*

The Examiner further asserts in section 39 that, regarding claim 33, *Sutherland et al.* further teaches/suggests a span for analysis as the span when the dye is present [para. 3, last three lines], a limitation that is not expressly disclosed in the combined invention of *Tuy et al. '043*, *De Bonet*, and *Peschman et al.*

The Examiner also asserts in section 40 that, regarding claim 36, per the analysis of claim 33, the acquired image sequence is confined within a predetermined time-space portion.

The Examiner also asserts in section 41 that, regarding claims 37 and 38, it would have been obvious to apply the ratio ranges recited in claims 37 and 38, respectively, because both perform the same function of reducing the size of a selected portion of an image sequence.

The Applicants submit that, as the combination of *Tuy et al. '043*, *De Bonet '642*, *Peschman et al. '021*, and *Sutherland et al.* fails to teach at least: selecting at least one frame, obtaining a single image from at least one frame, and applying lossless compression using an integer wavelet transform to the distribution of pixels in the at least one frame. Accordingly, the Applicants respectfully request that the rejection of Claims 32, 33 and 36-38 under 35 USC §103(a), also be withdrawn.

In section 42 of the Action, Claims 35 was rejected under USC §103(a) as being unpatentable over *Tuy et al. '043*, *De Bonet '642*, *Peschman et al. '021*, *Sutherland, et al.*, and further in view of *Matsugu et al.* (US 6,167,167).

The Examiner asserts in section 43 that, regarding claim 35, *Matsugu et al. '167* suggests the use of a binary mask, a limitation that is not expressly disclosed in the combined invention of *Tuy et al. '043*, *De Bonet*, *Peschman et al.*, and *Sutherland et al.*

The Applicants submit that, as the combination of *Tuy et al.* '043, *De Bonet* '642, *Peschman et al.* '021, *Sutherland et al.*, and *Matsugu et al.* '167 fails to teach: selecting at least one frame, obtaining a single image from at least one frame, applying lossless compression using an integer wavelet transform to the distribution of pixels in the at least one frame, and defining a space sequence with a binary mask. Accordingly, the Applicants respectfully request that the rejection of Claim 35 under 35 USC §103(a) be withdrawn.

Should the Examiner believe that anything further is needed to place the Application in condition for allowance, the Examiner is requested to contact Applicant's undersigned representative at the telephone number below.

Respectfully submitted,

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Date: October 19, 2009

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